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IS 7326-3 (1976): Penstock and turbine inlet butterfly valves for hydropower stations and systems, Part 3: Recommendations for operations and maintenance [WRD 12: Hydraulic Gates and Valves]



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IS: 7326 ( Part III ) - 1976

*Indian Standard*

PENSTOCK AND TURBINE INLET  
BUTTERFLY VALVES FOR HYDROPOWER  
STATIONS AND SYSTEMS

PART III RECOMMENDATIONS FOR OPERATIONS  
AND MAINTENANCE

( First Reprint MARCH 1983 )

UDC 627.844:621.646.25



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INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 RAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## PENSTOCK AND TURBINE INLET BUTTERFLY VALVES FOR HYDROPOWER STATIONS AND SYSTEMS

### PART III RECOMMENDATIONS FOR OPERATIONS AND MAINTENANCE

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# *Indian Standard*

## PENSTOCK AND TURBINE INLET BUTTERFLY VALVES FOR HYDROPOWER STATIONS AND SYSTEMS

### PART III RECOMMENDATIONS FOR OPERATIONS AND MAINTENANCE

#### 0. FOREWORD

**0.1** This Indian Standard (Part III) was adopted by the Indian Standards Institution on 30 September 1976, after the draft finalized by the Hydraulic Gates and Valves Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** The butterfly valve is one of the types of shut-off devices most commonly employed in hydropower stations and systems. Its use is favoured because of its relatively low cost, compactness, light weight, reasonable water tightness and simplicity of operation.

**0.2.1** Basically, butterfly valve (*see* Fig. 1) consists of a circular, lens shaped or open frame moving disc and body. The disc is pivoted in the body by two trunnions. When open the plane of symmetry of the disc lies parallel to the penstock axis.

**0.3** It serves the following purposes:

- a) Stops the flow of water to the turbine when the latter is stopped to decrease water leakages and to protect the guide vanes against slit cavitation and erosion.
- b) Stops the flow of water in case of emergency, that is, non-closure of guide apparatus or in the event of low oil pressure in the system.
- c) Unit isolation in multi-unit plants where one penstock feeds more than one unit.

**0.4** This standard is being published in parts. Part I deals with the structural and hydraulic aspects of design. Part II deals with the guidelines for design and selection of control equipment used in butterfly valves. Part III deals with the operation and maintenance of butterfly valves.

**0.5** In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

## 1. SCOPE

1.1 This standard ( Part III ) covers the instructions for operation and maintenance of the butterfly valves ( *see* Fig. 1 ).

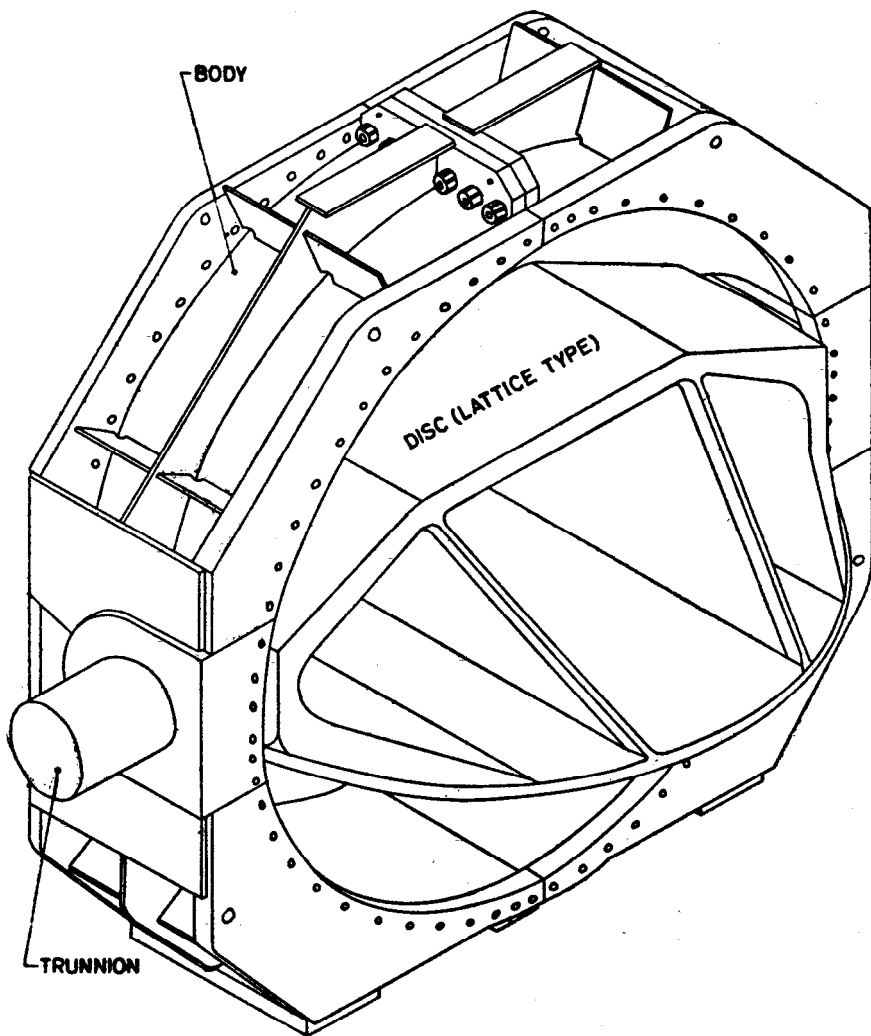


FIG. 1 BUTTERFLY VALVE



## **2. PREPARING THE VALVE FOR FIRST OPERATION**

- 2.1** All the operations of preparing the valve for first opening shall be carried out in empty condition of penstock.
- 2.2** Pistons of the servomotors in closed position of valve should come to end position. If required it can be achieved by adjusting arrangement of the servomotors.
- 2.3** The oil pressure unit shall be checked for correct operation and the pressure relays shall be set to operate at required pressures.
- 2.4** Tightness of all the pipe lines shall be checked.
- 2.5** All the points shall be lubricated by means of locally provided lubricators or from centralized lubrication system.
- 2.6** Time of opening and closing of the valve shall be regulated by means of throttle device provided. Opening of throttle should be the same in both the throttles where two servomotors have been provided.
- 2.7** Time of opening and closing of bye-pass arrangement shall be adjusted in case of hydraulically operated bye-pass valve as specified by use of throttle device provided on them.
- 2.8** It shall be ensured that proper electric wiring has been done for supplying the required voltage to the electro-magnets of the slide valve provided for the control of the valve.
- 2.9** Contacts of limit switches or any other type of switches shall be checked as per the requirement of operation. Correct operation of indicating lamps for different signals shall be checked.
- 2.10** The correctness of sequence of operations during opening and closing of valve shall be checked.
- 2.11** Pressure gauges shall be checked and set correctly. Closing of contacts of pressure switches shall be adjusted and set at required values.
- 2.12** Dust and dirt from all the parts shall be cleaned and all the manholes and openings shall be closed.
- 2.13** After all the above checks are made, valve shall be opened and made sure that all the mechanisms of the system are operational and in position corresponding to the open position of the valve.
- 2.14** After checking the opening operation, valve shall be closed and it should be made sure that all the mechanisms of the system of operation are in position corresponding to the closed position of the valve.
- 2.15** Drain valves of butterfly valve and penstock shall be closed.

### **3. CHECKING AND TESTING WITH WATER FILLED PENSTOCK**

**3.1** It shall be checked that there is no leakage of water from flange joints. Leakage through seals should not exceed one litre per minute per metre length of seal.

**3.2** Impulse for opening the valve should be given. The minimum pressure difference between upstream and downstream shall be noted.

**3.3** Opening and closing of the valve shall be carried out and correctness of sequence of operation and timings shall be checked.

**3.4** Closing the valve from the minimum allowable oil pressure shall be checked while pumps of oil pressure units are stopped.

### **4. NORMAL OPENING AND CLOSING**

**4.1** The valve shall always be opened under balanced head condition.

**4.2** Normal opening and closing of the valve shall be carried out according to the prescribed sequence of operation.

### **5. SERVICING DURING OPERATION**

**5.1** Tighthess of all the connections shall be checked periodically according to the prescribed schedule.

**5.2** Lubrication of all the points shall be carried out systematically from a centralized lubrication system or from lubricators locally provided on the points at prescribed intervals.

**5.3** Grease shall be filled periodically in the tank of centralized grease of lubrication system and in the lubricators locally provided.

**5.4** System of indications and signalling shall be checked periodically and fused lamps shall be changed.

### **6. REPLACEMENT OF SEALS**

**6.1** Adjustment and replacement of main seal and trunnion seals shall be done according to the prescribed instructions.

### **7. STORAGE OF SPARE PARTS**

**7.1** Spare parts shall be stored in the proper packings in dry and cool premises. These shall be protected against direct sun rays, rainfall and dust.

**7.2** The condition of the spare parts shall be checked at least every six months.

**7.3** Spare seals, rubber cords and other rubber parts shall be sprinkled with rubber talcum powder and then wrapped in polyethylene paper.

# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

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